Year 1 - Week 5 - Mixed Exam Questions

Mark scheme

Question 1

(a)

Answer	Marks	Guidance
$2-x<1+3(x-2)$ $\Rightarrow 2<4x-5$ $\Rightarrow 4x>7$ $\Rightarrow x>\frac{7}{4}$	**B1** **B1** **B1**	Remove brackets giving rhs $1+3x-6$ or better **Ft** Result in the form $ax>b$ **oe**
	[3]	

(b)

$-6<2x-1<7$ $\Rightarrow -5<2x<8 \Rightarrow -\frac{5}{2}<x<4$

Question 2

Question			Answer	Marks	Guidance	
6	(i)		(i) × 3: $9x+12y=54$ (ii) × 4: $28x-12y=20$ Add: $37x=74$ $\Rightarrow x=2$ $\Rightarrow y=3$	M1 M1 A1 A1	Making a coefficient the same Elimination	Alternatively soln by substitution SC Answer only or www seen B4
				[4]		
	(ii)		Sketch to show two lines, one +ve gradient and one –ve, intersecting at *their* point from (i)	B1 B1	Two lines Dep. *Their* intersection	
				[2]		

Question 3

Question			Answer	Marks	Guidance	
8	(i)		$\frac{x+a}{x}+\frac{x-2}{4}=0$ $\Rightarrow 4x+4a+x^2-2x=0$ $\Rightarrow x^2+2x=-4a$ $\Rightarrow x^2+2x+1=1-4a$ $\Rightarrow (x+1)^2=1-4a$	M1 M1 A1	Clear fractions on lhs Collection of terms to a 3 term quadratic and attempt to complete the square Correct final form	"Attempt" means make lhs include $x^2+2px+p^2$
				[3]		
	(ii)		(Roots if) *their* $q \geqslant 0$ $\Rightarrow a \leqslant \frac{1}{4}$	M1 A1	Soi. Allow use of >$$ **ft** *their* q . correct inequality.	Allow = here only if ans is correct. Allow expansion of quadratic and use of discriminant
				[2]		
	(iii)		$(x+1)^2=5$ $\Rightarrow x=-1\pm\sqrt{5}$	M1 A1	Substitute to obtain quadratic in form $(x+p)^2=n$ Both required isw	Allow use of formula
				[2]		

Question 4

Question			Answer	Marks	Guidance	
14	(a)	(i)	$s=\frac{1}{2}2t^2\left(=t^2\right)$	B1		
				[1]		
		(ii)	90 km h^{-1} = 25 m s^{-1} or 2ms^{-2} = 25920 km hr^{-2}	B1	Units must be given - others are possible	Beware mixing of units which could give 12.5
			$v=2t \Rightarrow 25=2t$	M1	Application of $v=u+at$ with consistent units	
			$\Rightarrow t=12.5$ secs	A1	Units must be given	
				[3]		

Question 5

Question			Answer	Marks	Guidance	
2			Line is $\pm 3x \pm 2y = k$ $3x-2y=k$	M1 A1	Swapping coefficients Correct form	Alt: gradient of line $=-\frac{2}{3}$ **B1** soi accept $-\frac{2}{3}x$ $\Rightarrow$ grad of perp $=\frac{3}{2}$ **M1** for finding numerical perp
			Satisfies $(3,-1)$ $\Rightarrow k=9+2=11$ giving $3x-2y=11$ **oe**	M1 A1	Substituting into *their* equation Final equation three terms only must be seen	$\Rightarrow y=their\frac{3}{2}x+c$ **M1** substituting $(3,-1)$ that is not parallel to the original line $\Rightarrow y=\frac{3}{2}x-5.5$ **oe** **A1** i.e. writing "c = – 5.5" only loses last A mark
				4		

Question 6

Question			Answer	Marks	
4	(i)		$AB = \sqrt{(1--3)^2+(5-7)^2}\ \left(=\sqrt{16+4}\right)$ $\Rightarrow AB = \sqrt{20}\quad \left(=2\sqrt{5}\right)$ (isw for any decimal given)	M1 A1	Applying Pythagoras correctly
				2	
	(ii)		$(-1,6)$	B1	
				1	

Question 7

Question			Answer	Marks	Guidance	
7	(i)		$\Rightarrow x+7=3+5x-x^2$ $\Rightarrow x^2-4x+4=0$ oe $\Rightarrow x=2,$ $y=9$	M1 A1 A1 A1 4	Substitute, eliminating x or y. 3 term quadratic. x(or y) Substitute and find y (or x).	Or $y^2-18y+81=0$
	(ii)		Line is tangent to curve (at (2, 9))	B1 1	Allow "touches".	Or a sketch with any parabola touched by any line

Question 8

Question			Answer	Marks	Guid
8	(i)		Grad AB = Grad CD $=1$ $\left(=\frac{4--1}{0--5}\right)$ and $\left(=\frac{-2-3}{2-7}\right)$ **oe**	**B1**	For showing one pair of gradients equal and correct **www**
			Grad BC = Grad AD $=-\frac{1}{7}$ $\left(=\frac{3-4}{7-0}\right)$ and $\left(=\frac{-2--1}{2--5}\right)$		
			Two pairs of parallel sides (means ABCD parallelogram)	**B1**	For showing other pair of gradients equal and correct plus completion
				[2]	
	(ii)		$AB^2 = 5^2 + 5^2$ (=50) **oe** for any side	**B1**	One length (or squared length)
			$BC^2 = 1^2 + 7^2$ (=50)		
			$\Rightarrow AB^2 = BC^2$ (=50)	**B1**	For adjacent length plus completion **www**
			Equal sides (means rhombus)	**[2]**	
	(iii)		Gradients do not fulfil $m_1 . m_2 = -1$ **oe**	**M1**	For use of $m_1 . m_2 = -1$
			ie $1 \times -\frac{1}{7} \neq -1$		
			Therefore lines not perpendicular	**A1**	Gradients must be correct.
				[2]	
			Alternatives:		
			A: Use of cosine rule	**M1**	
			Does not give 90^0	**A1**	**www**
			B: Use of Pythagoras	**M1**	
			Not satisfied therefore not 90^0	**A1**	**www**
			C: Use of pythagoras to find length of diagonals	**M1**	
			(i.e. $\sqrt{160}$ and $\sqrt{40}$)		
			Diagonals not equal	**A1**	**www**

Question 9

Q	Marking Instructions	Marks	Typical Solution
(a)	***Note:** Vectors in mark schemes are in bold type. Handwritten vectors should be underlined (do not penalise through loss of marks).* $\overrightarrow{BE} = \frac{2}{3}\mathbf{a}$ or $AE = \frac{5}{3}\mathbf{a}$ **(OE)** $\overrightarrow{ED} = -\overrightarrow{BE} - \overrightarrow{AB} + \overrightarrow{AD}$ (using *their* $\overrightarrow{BE}$) Correct final answer (must be simplified).	**B1** **M1** **A1** **3 marks**	$\overrightarrow{AB} = \mathbf{a}$, $AB : BE = 3 : 2$ $\overrightarrow{BE} = \frac{2}{3}\overrightarrow{AB}$ $= \frac{2}{3}\mathbf{a}$ $\overrightarrow{ED} = -\overrightarrow{BE} - \overrightarrow{AB} + \overrightarrow{AD}$ $= -\frac{2}{3}\mathbf{a} - \mathbf{a} + \mathbf{b}$ $= -\frac{5}{3}\mathbf{a} + \mathbf{b}$
(b)	$\overrightarrow{EF} = \frac{2}{5}\overrightarrow{ED}$ Correct final answer (must be simplified).	**B1** **A1** **2 marks**	Using 'similar triangles': $\overrightarrow{EF} = \frac{2}{5}\overrightarrow{ED}$ $= \frac{2}{5}\left(-\frac{5}{3}\mathbf{a} + \mathbf{b}\right)$ $= -\frac{2}{3}\mathbf{a} + \frac{2}{5}\mathbf{b}$